- The standard dry cell (battery) has the following shorthand notation:
  \[ \text{Zn(s)} \mid \text{Zn}^{2+}(\text{aq}) \parallel \text{MnO}_2(\text{s}), \text{Mn}_2\text{O}_3(\text{s}) \mid \text{graphite(s)} \]

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Which component of the battery is the anode?

Give the balanced half equation that takes place at the anode.

Which component of the battery is the cathode?

Give the balanced half equation that takes place at the cathode.
The bacterium *Azotobacter chroococcum*, growing aerobically in a medium free of nitrogen containing compounds, obtains all of its nitrogen by the "fixation" of atmospheric N\(_2\). The solubility of N\(_2\) in water is governed by the following equilibrium:

\[
\text{N}_2(\text{aq}) \leftrightarrow \text{N}_2(\text{g}) \quad K = 1.6 \times 10^3 \text{ atm L mol}^{-1}
\]

What is the concentration of dissolved N\(_2\) available to the bacterium at 1.0 atm and 30 °C? (Air is 78% N\(_2\).)

Answer:

A culture of these bacteria (1.0 L) grows to a density of 0.84 mg dry weight per mL of culture and has a nitrogen content of 7.0% of the dry weight. What volume of air at 1.0 atm and 30 °C would supply this nitrogen requirement?

Answer:
The mechanism of copper toxicity to aquatic organisms is unknown. Most theories attribute the toxicity to the Cu$^{2+}$ species because Cu$^+$ is unstable in aqueous solution. Given the half-reactions and half-cell potentials on the data page, show that it is electrochemically favourable for Cu$^+$ (aq) to react with itself to form Cu$^{2+}$ (aq) and Cu(s).

The Co$^{3+}$ ion is unstable in aqueous solution, but for a different reason to Cu$^+$ above. Using the table of reduction potentials on the data page, propose the reason why this might be so.